California Energy Commission
Public Interest Energy Research (PIER) Program
ENVIRONMENTAL AREA RESEARCH

Quantification of Black Carbon Emissions From Cookstoves

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Fact Sheet

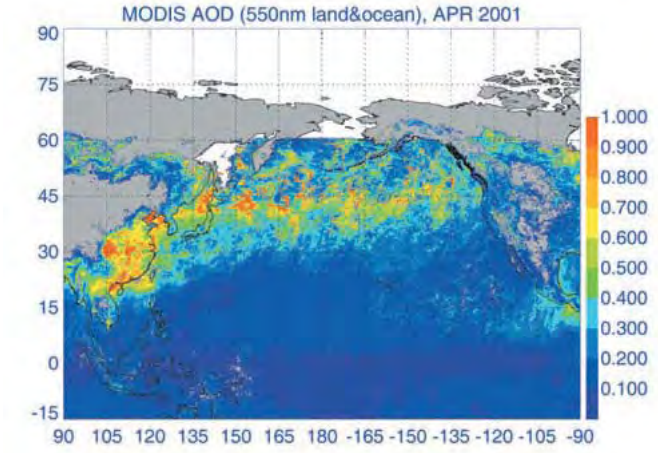
The Issue

Black carbon, found worldwide and commonly known as soot, enters the air when fossil fuels, biofuels, and biomass—such as coal, wood, and diesel fuel—are burned. Black carbon not only affects human health and visibility, but also contributes to global climate change.

Black carbon warms the planet by absorbing solar radiation in the atmosphere; by reducing albedo, the Earth's ability to reflect sunlight, when deposited on snow and ice; and by contributing directly to the melting of snow and ice. There is growing concern that this increased snow and ice melt may contribute to the depletion of fresh water reservoirs stored in mountain glaciers and snow pack.

Although black carbon stays in the atmosphere for a relatively short time—only several days to a few weeks—it is a potent climate-forcing agent and a key contributor to global climate change. Due to black carbon's short atmospheric lifespan, reducing black carbon emissions can immediately mitigate climate change and reduce impacts on water resources.

Global emissions inventories indicate that more than half of black carbon particles are produced in Asia. Black carbon emissions from Asia not only impact regional climate, but are transported long distances and may have impacts on a global scale. Research indicates that approximately 25 percent of the black carbon aerosols deposited on the snowpack in the Sierra Nevada mountain range likely originates from Asia.



Spectroradiometer Imaging shows transport of particulate pollution from Asia to North America during April 2001
Graphic source: Hadley 2007

Project Description

In South Asia, biofuel cooking accounts for the majority of black carbon emissions. This research will measure the emissions of black carbon soot from two types of cookstoves: the traditional "three-stone fire" and the Berkeley Darfur Stove. The Berkeley Darfur Stove, designed as a more fuel-efficient alternative to the "three-stone fire," may have the added benefit of reducing pollutant emissions, including black carbon.

This project's goals are to:

- Conduct experiments to quantify emissions from cookstoves. Emissions measurements

will be performed under laboratory test conditions at the cookstove testing facility at Lawrence Berkeley National Laboratory.

- Test variations of the Berkeley Darfur Stove and the traditional "three-stone fire." Gas and particulate phase pollutants will be measured during cooking with each stove over all modes of operation, from start-up to smoldering embers.
- Characterize fuel wood by moisture content, surface-to-volume ratio, and density. The stoves will be evaluated using wood as the fuel while boiling various volumes of water to simulate cooking conditions.
- Compare results of laboratory test emissions to data in the literature.
- Present research results to the California Energy Commission and the American Geophysical Union conference.

PIER Program Objectives and Anticipated Benefits for California

This project will help measure the reduction in emissions from the Berkeley Darfur Stove relative to traditional cooking fires. This will allow quantitative estimates as to how the use of more efficient stoves in developing nations may reduce atmospheric black carbon, and how this, in turn, will reduce the amount of transported pollution to North America, specifically to California.

Reducing the amount of black carbon deposited on the Sierra Nevada snowpack will reduce the impact of black carbon on local and state water supplies. Because water is closely tied to energy production, the associated impacts on energy generation will be reduced as well, helping to ensure secure, stable, and reliable sources of energy for the state.

Project Specifics

Contract Number: 500-99-013
Contractor: Regents of the University of California and the California Institute for Energy and Environment
Amount: $99,999
Term: August 2009 to December 2010

For more information, please contact:
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